The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 1,3,8-12,17,18,27 and 29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hark patent 4,808,287 in view of Batchelder et al patent 6,126,805, Sato et al patent 6,733,646 and Zhang patent 6,780,328. Hark discloses a system for producing treated

water comprising introduction of a municipal water supply stream into a point of entry that may be considered to be the inlet to prefilter 1 vessel 2-4 or eventually reverse osmosis vessel 6 or 8, intermediate treatment means of carbon filters and reverse osmosis units, and removal of undesirable species in electrochemical or electrodialysis (EDI) device/unit 9 [as in claim 10]. Evidently, water continuously flows through all points of the system (flowing to and through the pretreatment vessels, while flowing to the downstream EDI unit) since Rela infers long-term operation of the system (column 1, lines 33-37) and continuous flow (column 2, line 57 and column 4, line 47). It is stated that the voltage in the EDI unit is controlled by a controller and electric current periodically reversed for the purpose of cleaning off contaminants that deposit on the electrodes (column 4, lines 38-50). Treated water is then distributed to points of use through pumps 23 and 25. Hark additionally discloses storing the water in reservoirs 22 and/or 24, of the "reservoir system". The system distributes water to points of use for medical purposes or in the food processing or plating industries where ultrapure water is necessary.

The claims all differ in requiring that the electrical current is maintained below a limiting current density to suppress hydroxyl ion generation. Batchelder teaches that EDI-containing water treatment systems are operated near or below the limiting current density, sometimes in combination with reversal of direction of the electric current (as in Batchelder) in order to mitigate the precipitation and deposition of minerals to contact surfaces (column 1, line 62-column 2, line 19 and column 4, line 42-column 5, line 2, etc.) Such actions are taught as reducing "water splitting" or formation of hydroxyl ions. It is noted that the water treated by Hark contains minerals among other contaminants (Hark at column 2, lines 33-45). More specifically, in column 8, lines 34-47 and column 12, lines 35-38 and 45-51, Batchelder

explicitly teaches operating the anion exchange membranes of an electrodialysis or electrodeionizing device to have a reduced water-splitting capacity and to operate the cation exchange membranes of such device to have a relatively limited water-splitting capacity compared to enhanced water splitting membranes, with such objectives realized by limiting current densities [as required by claim 3].

Thus, it would have been obvious for one of ordinary skill in the art to have controlled the EDI process in the Hark system by operating near or below the limiting current density to minimize water splitting, or formation of hydroxyl ions, as taught by Batchelder, to further limit the amount of precipitation occurring on the EDI surfaces and downstream of the device especially in the concentrating stream, so as to optimize the EDI operation in removal of salts and other contaminants.

The claims now also differ in requiring that the points of use be in a household. However, Sato et al teach that water treated by systems encompassing reverse osmois and electrochemical devices is equally well used for the industries specified by Rela as well as household use (column 1, lines 10-29 and column 7, lines 15-50). It would have been obvious to the skilled water treatment artisan to have utilized the treatment system of Rela for distribution to households, since there is a similar need for ultrapure water free of the varied contaminants the combination water treatment system entails.

The claims also now generally differ in requiring that storage occurs in the same "vessel" functioning as one or more pretreatment units, <u>or as in claim 17 with accompanying dependent claims, requiring the vessel to have a plurality of zones containing water of differing water quality level</u>. However, Zhang teaches combining active carbon filters, reverse osmosis

membranes and EDI units as plural units in common plural "stages" constructed for operation in series and/or parallel (column 5, line 66-column 6, line 8). Zhang also may combine plural units into a common stack or vessel (column 8, lines 33-38) and extends residence time in the treatment vessels (up to 100 minutes) sufficiently to constitute storage (column 7, line 61-column 8, line 8). Hence, it would have been also obvious to have treated and stored the water in common vessels or as sequential units arranged in series as zones in a common vessel, as suggested by the combination of Zhang, in order to achieve a more compact system occupying less space, and to extend exposure time of the water to the treatment elements to more completely purify it.

Similarly, claim 11 and claims dependent therefrom require water to be introduced such that a first portion is introduced into vessel and 2nd portion into EDI device, with portion of the vessel-introduced water routed into the EDI device. Similarly, Zhang teaches combining active carbon filters, reverse osmosis membranes and EDI units as plural units in common plural "stages" constructed for operation in series and/or parallel (column 5, line 66-column 6, line 8). With respect to claim 11, it would have been also obvious to have treated and stored the water in common vessels or as sequential units arranged in parallel and/or series as zones in a common vessel, as suggested by the combination of Zhang, in order to achieve a more compact system occupying less space, while tailoring water quality to an exact specified quality by treating desired portions in the different treatment units arranged in parallel.

For claims 8,9, and 29, the water in the Hark system is inherently pressurized to a given degree by the upstream municipal water supply stream (column 2, lines 33-35) and further pressurized by pumps 5 and 7.

For claim 18, as Sato specifies household use of treated water, such water is necessarily introduced into some sort of distribution system and household point of use or appliance.

For claim 27, Rela also discloses that treated and recycled water is mixed with water from the point of entry (upstream of pre-filtration unit 1) between activated carbon filter 2 and carbon filter 3.

Claims 4-7,13-16,19,20,28,30 and 31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hark in view of Batchelder, Sato et al patent 6,733,646 and Zhang patent 6,780,328, and additionally in view of Rela patent 6,607,668.

Claims 4-7,13-16,19,20,31 and 32 all further differ from Hark in requiring measuring of at least one water property and controlling at least the EDI device based on such property. However, Rela teaches a water treatment system that includes prefilter, reverse osmosis and use of an EDI unit such as in Hark and in which various water properties are sensed/measured and sensed values are used by the controller to control flow rates of raw water, flow rates of the water being distributed to end use points, amount of current applied to the electrodeionization device and other system parameters (col. 4, l 43-67, col. 10. l 28-40). Rela also measures impurity removal of the system (column 1, lines 55-65, etc.) to be able to calculate percentage of the impurities removed [for claims 13 and 28].

It would have been also obvious to one of ordinary skill in the art to have incorporated the monitoring and control taught by Rela, into the Hark system, so as to optimize overall performance of the water treatment system.

Claim 22 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hark in view of Batchelder, Sato et al patent 6,733,646 and Zhang patent 6,780,328, and additionally in view of Andrews et al patent 6,458,257. Hark discloses a system for producing treated water comprising introduction of a municipal water supply stream into a point of entry that may be considered to be the inlet to prefilter 1 vessel 2-4 or eventually reverse osmosis vessel 6 or 8, intermediate treatment means of carbon filters and reverse osmosis units, and removal of undesirable species in electrochemical or electrodialysis (EDI) device/unit 9. Evidently, water continuously flows through all points of the system (flowing to and through the pretreatment vessels, while flowing to the downstream EDI unit) since Rela infers long-term operation of the system (column 1, lines 33-37) and continuous flow (column 2, line 57 and column 4, line 47). It is stated that the voltage in the EDI unit is controlled by a controller and electric current periodically reversed for the purpose of cleaning off contaminants that deposit on the electrodes (column 4, lines 38-50). Treated water is then distributed to points of use through pumps 23 and 25. Hark additionally discloses storing the water in reservoirs 22 and/or 24, of the "reservoir system". The system distributes water to points of use for medical purposes or in the food processing or plating industries where ultrapure water is necessary.

For claim 22, the water in the Hark system is inherently pressurized to a given degree by the upstream municipal water supply stream (column 2, lines 33-35) and further pressurized by pumps 5 and 7.

The claims all differ in requiring that the electrical current is maintained below a limiting current density to suppress hydroxyl ion generation. Batchelder teaches that EDI-containing water treatment systems are operated near or below the limiting current density, sometimes in

combination with reversal of direction of the electric current (as in Batchelder) in order to mitigate the precipitation and deposition of minerals to contact surfaces (column 1, line 62-column 2, line 19 and column 4, line 42-column 5, line 2, etc.) Such actions are taught as reducing "water splitting" or formation of hydroxyl ions. It is noted that the water treated by Hark contains minerals among other contaminants (Hark at column 2, lines 33-45). More specifically, in column 8, lines 34-47 and column 12, lines 35-38 and 45-51, Batchelder explicitly teaches operating the anion exchange membranes of an electrodialysis or electrodeionizing device to have a reduced water-splitting capacity and to operate the cation exchange membranes of such device to have a relatively limited water-splitting capacity compared to enhanced water splitting membranes, with such objectives realized by limiting current densities [as required by claim 3].

Thus, it would have been obvious for one of ordinary skill in the art to have controlled the EDI process in the Hark system by operating near or below the limiting current density to minimize water splitting, or formation of hydroxyl ions, as taught by Batchelder, to further limit the amount of precipitation occurring on the EDI surfaces and downstream of the device especially in the concentrating stream, so as to optimize the EDI operation in removal of salts and other contaminants.

The claims now also differ in requiring that the points of use be in a household. However, Sato et al teach that water treated by systems encompassing reverse osmois and electrochemical devices is equally well used for the industries specified by Rela as well as household use (column 1, lines 10-29 and column 7, lines 15-50). It would have been obvious to the skilled water treatment artisan to have utilized the treatment system of Rela for distribution to

households, since there is a similar need for ultrapure water free of the varied contaminants the combination water treatment system entails.

Andrews et al specifies that treated water may enter the whole house water distribution system for dispensing in bathing or showerhead appliances, drinking faucets and dishwashing or washing machine appliances, thus reducing the need for separate multiple point-of-use water treatment devices (column 8, lines 25-44).

Claim 32 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hark in view of Batchelder, Sato et al patent 6,733,646 and Zhang patent 6,780,328, and additionally in view of Andrews et al patent 6,458,257 as applied to claim 22 above, and further in view of Rela patent 6,607,668. Claim 32 also further differs from Hark in requiring measuring of at least one water property and controlling at least the EDI device based on such property. However, Rela teaches a water treatment system that includes prefilter, reverse osmosis and use of an EDI unit such as in Hark and in which various water properties are sensed/measured and sensed values are used by the controller to control flow rates of raw water, flow rates of the water being distributed to end use points, amount of current applied to the electrodeionization device and other system parameters (col. 4, l 43-67, col. 10. l 28-40). Rela also measures impurity removal of the system (column 1, lines 55-65, etc.) to be able to calculate percentage of the impurities removed for claim 13.

It would have been also obvious to one of ordinary skill in the art to have incorporated the monitoring and control taught by Rela, into the Hark system, so as to optimize overall performance of the water treatment system.

Applicant's arguments with respect to claims 1,3-20,22 and 27-32 have been considered but are moot in view of the new ground(s) of rejection including teachings of Zhang, Sato and Andrews.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Joseph Drodge at telephone number 571-272-1140. The examiner can normally be reached on Monday-Friday from 8:30 AM to 5:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Duane Smith, can reached at 571-272-1166.

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JWD
10/19/2009
/Joseph W. Drodge/
Primary Examiner, Art Unit 1797